

Appl. No. 10/711,369
Amdt. dated October 24, 2005
Reply to Office action of July 27, 2005

REMARKS/ARGUMENTS

This is in response to an Office action dated 7/27/2005.

Claims 1-20 are pending.
Claims 1-10, 20 are withdrawn from consideration.
Claims 11-19 are rejected.

The Restriction Requirement

Claims 1-10 and 20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a non-elected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 05/31/05. The applicants argument traversing the Restriction has been considered but is not persuasive. Specifically the methods are not found to be intimately related to the slurry as argued by applicants, and in some instances there is not a one to one correspondence between the method claims and slurry claims, as also argued by applicant. Note for example only, the "adding" requirement of claim 1, and claim 20 in its entirety. Additionally, these considerations do not even take into account amendments that may be made to the claims during prosecution that could have the effect of further distinguishing the two groups of claims.

Claims 1-10 and 20 are canceled herewith.

Substantive Grounds of Rejection

Claims 11-19 are rejected under 35 U.S.C. 102(b or e) as anticipated by or, in the alternative, under 35 U.S.C 103(a) as obvious over Gorantla et al (US2004/0127045) or Cho et al (US2004/0221516). Either reference discloses all of the elements of the claims including a slurry containing ceria and silica in the claimed concentrations. In the event Gorantla or Cho is later deemed not to impliedly or expressly disclose a feature of the dependent claims, such would have been obvious to provide in either slurry for the purpose of improving its performance.

The Invention, Generally

According to the invention, generally, small quantities of silica are combined with ceria-based slurries to initiate oxide polish faster thereby increasing throughput and minimizing process instability due to changes in the initiation time with silica-less slurries. This minimizes the dead time at the beginning of the polish process thereby enhancing the throughput of the polish process. (page 9, second paragraph)

The silica in the slurry accelerates the onset of polishing. The ceria in the slurry interacts with the oxide surface, that is exposed as a result of the initial polish with silica, and continues to polish. (page 9, third paragraph)

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According to the invention, a quantity of silicon dioxide (fumed and/or colloidal silica) is added to the cerium oxide (ceria) based slurry in order to minimize the effect that the removed material has on subsequent polishing. The silicon dioxide in the resulting slurry causes material removal to begin very early on in the polish process without relying on the material removed from the wafer surface to aid in polishing. (page 14, second full paragraph)

It is believed that the mechanism responsible for this beneficial result is that the cerium oxide abrasive does not selectively adhere well to the surface of the wafer. This results in a very low initial removal rate. The oxide that is removed from the wafer in the initial stages of polish then adheres to the remaining oxide on the wafer and increases the removal rate. The added silica abrasive adheres better to the surface of the oxide thereby enhancing its removal rate. (page 14, third full paragraph)

By adding silica to ceria-based CMP slurries the polish process starts much faster than without silica thereby eliminating dead time in the polish process and eliminating process instability caused by changes in the dead time with operating conditions. A slurry for performing chemical mechanical polishing (CMP) of patterned oxides (e.g., STI, PMD, ILD) on a substrate, comprises: ceria particles having a concentration of 1.0 - 5.0 wt% and silica particles having a concentration of 0.1 - 5.0 wt%. A ratio of ceria concentration to silica concentration (ceria:silica) is from approximately 10:1 to nearly 1:1 by weight. The ceria particles have a particle size of 150-250 nm, and the silica particles have a particle size of > 100 nm. The silica may be fumed or colloidal. The slurry has a pH of approximately 9.0. (Abstract)

Traversing the Rejection

Gorantla et al (US20040127045) and Cho et al (US20040221516) both disclose slurries with two or more abrasive particle types. Specifically, they both talk about mixtures of ceria and silica abrasives. However, the context is completely different than that of the present invention.

Cho et al describes using "small" colloidal silica particles as a means to improve slurry stability. The present invention describes using fumed silica particles and obtaining benefits from using the fumed particles. See claim 18.

Cho et al mentions that the colloidal particles used for improving slurry stability need to be much smaller than the "larger" abrasive particles. In the present invention, the sizes of both components of the slurry are comparable. See claims 15,16,17.

Gorantla et al discloses that the use of nanoparticles in the slurry improves the slurry performance. In fact, it is specifically mentioned (in paragraph [0037]) that the presence of large particles, defined as being greater than 100nm, in the slurry reduces the effectiveness of the slurry. In the present invention, both the components of the slurry are of comparable size and they are both greater than 100nm. See claims 15,16,17.

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Gorantla et al. picks the operating range for their pH to be 3 - 5 & 9 - 12. The slurry of the present invention has a pH of approximately 9. See claim 19.

The present invention claims that the use of ceria and silica in the ratio and wt% described in the example reduces the initiation time during polish.

As noted in the specification, "The pH of the slurry is in the range of from 7-12, such as approximately 9.0 (9 ± 0.5). The pH can be adjusted by adding a pH adjusting agent properly in a desired amount as occasion demands." (page 16, paragraph 103) Note that " 9 ± 0.5 " = from 8.5 to 9.5.

Newly-presented claim 21 is directed to the pH range.

Newly-presented claim 22 depends from claim 21, and narrows the range.

Newly-presented independent claim 23 combines the features of claims 11, 12, 15, 18 and 21.

Newly-presented claim 24 is similar to claim 13.

Newly-presented claim 25 is similar to claim 14.

Newly-presented claim 26 is similar to claims 16 and 17.

Newly-presented claim 27 is similar to claim 19.

Newly-presented claim 28 is similar to claim 22.

Claim Count

After entering this amendment, there are

17 total claims (11-19, 21-28)

2 independent claims (11, 23)

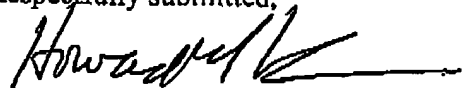
No excess claim fee is required.

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Conclusion

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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